

REMARKS

Summary of the Office Action

Claims 4-6 are objected to for informalities.

Claims 1 and 3-15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al. (U.S. Patent No. 6,426,991) and Chappo et al. (U.S. Patent No. 6,510,195) in view of Bauer et al. (U.S. Patent Application Publication No. 2002/0011640).

Claim 16 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al., Chappo et al. and Bauer et al. in further view of Yamanaka et al. (U.S. Patent No. 6,372,558).

Claim 26 is rejected under 35 U.S.C. § 102(e) as being anticipated by Chappo et al.

Summary of the Response to the Office Action

In response to the objection, claim 4 is being amended. Also, the rejections are respectfully traversed for the reasons set forth below. Specifically, Applicants respectfully submit that the references fail to teach at least the arrangement of the recessed portions and frame part as recited in independent claim 1, as well as the square shaped openings in the recesses of the semiconductor substrate of the back-illuminated photodiode array as recited in independent claim 26. In addition, new dependent claims 27 and 28 are being added.

Objection to Claims 4-6

The Examiner objects to the use of the term “comprising” in claim 4. Applicants respectfully submit that claim 4 is fully supported by the specification as originally filed. Nevertheless, to advance prosecution, claim 4 is being amended to include the language “composed of” which is recited in the original specification (see, for example, paragraph 0135 of the published application with reference to Figure 6). Accordingly, Applicants respectfully request that the Examiner withdraw this objection.

The 35 U.S.C. § 103(a) Rejection of Claims 1 and 3-15

This rejection is similar to that set forth in the final Office Action dated March 9, 2007. Applicants respectfully traverse this rejection.

As admitted by the Examiner, Mattson et al. fails to teach recessed portions. For this feature, the Examiner cites Chappo et al., and refers to items 52 and 54 in Figures 2 and 4, item 120 in Figure 10, and column 11, lines 4-8 of Chappo et al. as allegedly teaching the recessed portions. Applicants respectfully submit, however, that as described, for example, in column 6, lines 15-16 of Chappo et al., item 54 references “bond pads 54” that are present on the back side of the back-illuminated photodiode (BIP) array 52. Applicants respectfully submit that it is not reasonable to interpret “bond pads” as “recesses.” Furthermore, column 11, lines 4-8 of Chappo et al. merely states that “metal layers can be placed in notches or recesses formed in the peripheral edge 120” of an ASIC 258. That is, nowhere does Chappo et al. teach forming recesses in the BIP array 52. Rather, column 10, lines 32-35 of Chappo et al. state that the BIP array is

“bump bonded via bumps 56 to a matching array of electronics on a readout application-specific integrated circuit (ASIC) 258.” Accordingly, in no way does Chappo et al. teach forming recesses in the surface of the BIP array 52 opposite to that on which the scintillating layer 50 is formed, and thus cannot teach “a first conductive type semiconductor substrate having a light-incident surface and an opposite surface with a plurality of recessed portions located opposite said light-incident surface” as recited in independent claim 1 of the present application.

Concerning Bauer et al., Applicants respectfully submit that this reference fails to teach that the semiconductor substrate is thinner in recessed portions of the first conductive type semiconductor substrate than in portions around the recessed portions as the Examiner contends. Rather, Applicants submit that paragraph 0016 of Bauer et al. describes that “a single cell of the array comprises a central elevation which is formed by the second diode area 6.” Hence, as shown in Figures 1 and 2 of Bauer et al., these central elevations extend upward as peaks and, as further described in paragraph 0016 of Bauer et al., “[t]he first diode area 5 is arranged concentrically around the second diode area.” In other words, even assuming that the semiconductor substrate at the second diode area 6 is thicker than at the first diode area 5, this arrangement is opposite to that of the claimed embodiments in which “each of said recessed portions of said first conductive type semiconductor substrate is surrounded by portions of said first conductive type semiconductor substrate that form a frame part, located between a plurality of said recessed portions, which is thicker than and frames the respective recessed portion.” (emphasis added). Rather, in the Bauer et al. arrangement, the allegedly thicker second diode area 6 is surrounded by the thinner first diode area 5.

Applicants respectfully submit that for at least the above reasons, one skilled in the art would not have found it obvious or possible to have modified the Mattson et al. device in accordance with the teachings of Chappo et al. and Bauer et al. to have achieved the embodiment of the present invention even as recited in independent claim 1. Accordingly, independent claim 1, and all of its dependent claims, should be allowable over these references.

Applicants further submit that since, as demonstrated above, the references fail to teach a "frame part," then the references further fail to teach any of the specific features relating to the frame part as recited in dependent claims 7, 8 and 11-13.

In addition, new dependent claim 27 is being added which defines further features relating to the frame part. Applicants respectfully submit that the cited references fail to teach these additional features.

The 35 U.S.C. § 103(a) Rejection of Claim 16

This rejection is similar to that set forth in the final Office Action dated March 9, 2007. Applicants respectfully traverse this rejection.

In this rejection, the Examiner admits that Mattson et al., Chappo et al. and Bauer et al. fail to teach the crystal plane orientation recited in this claim. Nevertheless, the Examiner contends that Yamanaka et al. teaches this feature. However, Applicants respectfully submit that Yamanaka et al. fails to make up for the deficiencies in the teachings of Mattson et al., Chappo et al. and Bauer et al. as discussed above to have rendered even independent claim 1 unpatentable. Accordingly, all claims should be allowable.

The 35 U.S.C. § 102(e) Rejection of Claim 26

In this rejection, the Examiner contends that Chappo et al. teaches each and every feature recited in this claim. However, Applicants respectfully submit that as demonstrated above, Chappo et al. fails to teach forming recesses in the BIP array 52. Chappo et al. thus fails to teach “a back-illuminated photodiode array comprising a semiconductor substrate, wherein only one side of said semiconductor substrate has a plurality of recesses, and wherein each shape of openings of said recesses is square” as recited in claim 26. Accordingly, claim 26 should be allowable.

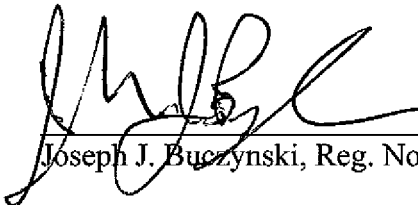
In addition, new dependent claim 28 is being added which depends from claim 26 and defines further features relating to the frame part. Applicants respectfully submit that the cited references fail to teach these additional features.

CONCLUSION

In view of the foregoing, Applicants submit that the pending claims are in condition for allowance, and respectfully request withdrawal of all outstanding objections and rejections, and request the timely allowance of the pending claims. Should the Examiner feel that there are any issues outstanding after consideration of this response, the Examiner is invited to contact Applicants' undersigned representative to expedite prosecution. A favorable action is awaited.

EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. § 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 50-0573. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,



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Dated: August 29, 2008

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